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THE UNIVERSITY OF MICHIGAN
DIVISION OF RESEARCH DEVELOPMENT AND ADMINISTRATION

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Ann Arbor, MI 48109-1248

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September 28, 1990

Office of Naval Research
Code 11SP
800 North-Quincy Street
Arlington, VA 22217

Attention: Debra T. Hughes

Subject: Office of Naval Research Grant N00014-90-J-1972

Enclosure: Interim Report

In accordance with the reporting requirements for this grant and on behalf of Robert Beck, the project director, and myself, please find enclosed the interim report on activities under Grant N00014-90-J-1972 during the period May 1990 through September 1990.

If you have any questions, please contact me at (313) 763-6438.

Sincerely,

Neil D. Gerl, Ph.D.

Project Representative

NDG:jes

Enclosure

cc: Robert Beck

Patricia M. Wyatt

Director, Naval Research Laboratory

Defense Technical Information Center

David J. Wyner, ONRRR

Mary Gibbons

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Office of Naval Research High School
Traineeship at the University of Michigan
Interim Report
Grant N00014-90-J-1972
Submitted to: Office of Naval Research
Deputy Director: Debra T. Hughes
by Professor Robert Beck and Dr. Neil D. Gerl
September 1990

Project Number	
Project Title	
Project Description	
Project Objectives	
Project Results	
Project Conclusions	
Project Recommendations	
Project Status	
Project Funding	
Project Personnel	
Project Publications	
Project Other	

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STATEMENT "A" per D. Hughes
ONR/Code 11SP
TELECON

10/11/90

CG

The University of Michigan proposal to participate in the Office of Naval Research High School Apprenticeship Program was organized to reduce the administrative burden on project directors. As a result, the level of participation was excellent and all participants were pleased with the program.

All thirty-five project directors with Navy grants and contracts were given an explanation of the program and were asked to serve as mentors. Fourteen project directors agreed to it with the understanding that they would not be required to administer by the program. Reasons given for non-participation included: safety in the laboratory, subject matter of the research was too complex, and lack of available time to serve as a mentor.

Upon approval of the Office of Naval Research High School Traineeship program at the University of Michigan 1990, recruiting efforts began to get the program underway. An introductory letter (Enclosure A) was sent to high schools in or relatively near the Ann Arbor area requesting the nomination of students. Students interested in gaining valuable experience in science, math and engineering-related fields while earning \$1,000 over the summer were encouraged to apply.

Initially, twelve applications were received from nine different high schools. Although this was less than what had been expected (there were 14 \$1,000 stipends), the students who did apply were outstanding; most were at the top of their classes, had near 4.0 grade point averages, and scored above average on standardized tests such as the ACT and the SAT.

To introduce the students to the program, a welcoming meeting was held on June 14, 1990. Neil Gerl, a project representative at the Division of Research Development and Administration (DRDA) discussed the basic history of Naval research, ongoing research at the University of Michigan, and the type of research that the students would be involved with. The students were also acquainted with the professors and the projects on which they would be working. The professors and students were matched according to qualifications, personal preference, or similar research interest.

All of the participants were hired as temporary employees of the University of Michigan at an hourly wage of \$5.00 (200 hours x \$5.00/hour = \$1,000). Work permits were required as all of the students were under 18 years of age. Within two weeks, each

student was at work on his or her project. Payments were scheduled on a bi-weekly basis. All hours were reported to DRDA and paychecks distributed at the same location.

Although most of the participants' projects went smoothly, a few special cases did surface. For instance, one young man from a Detroit high school had been selected but would not have been able to participate because of lack of transportation from Detroit to Ann Arbor. Fortunately, housing was made available to him at no cost and he was able to fully participate in the program. In another case, a young man, who had been working in a laboratory where there were potentially dangerous chemicals, expressed concern for his own safety and asked to be removed from the project. After an inquiry, the laboratory was found to be safe but the student was assigned to another project where he would feel more comfortable.

The majority of complications occurred in the areas of: publicity, employment, and paychecks. Initially, the introductory letter (Enclosure A) was sent to the principals of the selected high schools. Unfortunately, very few letters were noticed let alone forwarded to the proper individuals in a timely manner. Follow-up calls were made to the counselling offices and response increased considerably. Basic employment processes also presented a problem. The fact that Neil Gerl would be required to receive authorization from Robert Beck (principal investigator) to sign employment forms and time cards was unforeseen so there were a large number of employment forms returned to the office for reprocessing. Also, since the University does not hire many employees under the age of 18, it was not known ahead of time that work permits would be necessary. Unfortunately, the delay in the submission of time cards, employment forms and work permits prevented the students from receiving their first paychecks in a timely manner.

It is also necessary to note that some of the Office of Naval Research projects that were initially to be supported in the proposal were not actually supported, and, in some cases, Office of Naval Research projects that were not mentioned in the proposal were supported instead. A list of the projects, the project directors, and the high school students that worked on the projects is included (Enclosure B). Currently there are remaining funds for two more students who are in the process of being matched up with an appropriate professor.

The main requirement for the students apart from actually working on the projects, was that they submit a one page summary of their experience (Enclosures C & D). The summaries received to date have shown enthusiasm for the program. Not only did this

program encourage students to become interested in engineering, it has established further studies for one student, who wrote:

"I think the Navy should offer this program again. Because of this program I am going to do a mentorship with Dr. Meadows during the school year."

Another impressive aspect of this program was the amount of responsibility the students were given. Many of the students were involved directly with experiment preparation, data collection and analysis.

Based on the success of "Office of Naval Research High School Traineeship at the University of Michigan 1990", it is proposed that this program be continued next year at the same cost.

Project Budget

Period: March 31, 1991 - March 31, 1992

•14 Traineeships @ \$1,000 Stipend each	\$14,000
•Program Administration (temporary manpower @ \$20 per hour x 100)	\$2,000

Total Cost:	\$16,000
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A final report on the project will be submitted upon completion of the Winter term. At the time it is planned to track the students to determine if the program had significant influence on their academic careers. It is also planned to investigate the feasibility of expanding the program to serve students that live outside the Ann Arbor area. Only one student was a dorm resident this year and it worked out very well, however, there are some concerns about liability and cost. It is clear that the students and their families developed a positive image of Navy research in a university and enjoyed a unique academic experience. It is requested that you provide suggestions on improving the Michigan program. We plan to recognize each student with a certificate for participating. If your office has any ideas on this, please advise.

ENCLOSURE A

May 3, 1990

The purpose of this letter is to request a nomination from your high school for our **"Office of Naval Research (ONR) High School Students Traineeship at the University of Michigan 1990."** The University of Michigan and ONR recently established this program as an effort to foster interest among high school students to pursue education and research at the university level.

The traineeship program will introduce high school students to on-going scientific research sponsored by the ONR. The program is to be launched this summer on the Ann Arbor campus. Current year juniors are being recruited from area schools to participate in research activities under the guidance of University scientists. These project directors have agreed to select and supervise one student per research project to assist with the recording of data, calculations, measurements, library searches, observation or research procedures, and general laboratory and/or office tasks. The students will gain concrete experience from the traineeship and from completing brief written reports summarizing their individual involvement.

The final selection will be based on personal interviews with the project directors. The students, preferably current year juniors, should possess some background in math, science, and computers. Each student is expected to work with the assigned project for a total of 200 hours, based on a flexible schedule (hours, full time or part time) to be determined by the researcher. The students will be present from June 20 through the summer, and into the fall term if needed. The ONR is offering a \$1,000 stipend to each student trainee for participation during the work period. A University management office will be responsible for ensuring that the students comply with the traineeship award agreement and for arranging the payment of the stipends.

The letter of recommendation may include information on whether the student is college-bound, has taken science courses, any technical interests, grade point average, etc. A resume and/or transcript may also be submitted along with the nomination.

Just to give you an idea of the research involved here, I am introducing the titles of the 14 on-going ONR research projects at the University of Michigan in which students may participate. The nature of the research has no bearing on the selection of the students who are primarily expected to learn, while assisting the project directors, graduate students, and other researchers.

1. Nonlinear Ship Motions
2. Program for Ship Hydrodynamics
3. On-line Aiding for Human-Computer Interfaces
4. Supersonic Multiphase Mixing Layers

5. Electron Beam Analysis for Cyclotron Harmonic and Free Electron Laser Devices
6. Recombination and Line Coincidence Concepts of X-Ray Lasing
7. Explanation-based Knowledge Acquisition of Electronics
8. Computational Aspects of Mechanics of Nonlinear Composite Materials
9. LeGrangian Velocity Profiles in the Full Scale Wake
10. Modulated Semiconducted Structures
11. Transport in Sio2 on the Picosecond and Femtosecond Timescales
12. A Structured Characterization of Real Time Computing Systems
13. Problems in Nonlinear Partial Differential Equations
14. Investigation of New-Time-Frequency Analyses of Acoustic Transients

The deadline for submission of the nomination is May 24. If there are any questions, please do not hesitate to call me at (313)763-6438. Thank you for your support in launching this exciting program!

Sincerely,

Neil D. Gerl, Ph.D.
Project Representative

NDG:sak

Application Cover Sheet
(please attach to letter of recommendation)

Student's Information

Name: _____

Social Security Number: _____

Age: _____

High School: _____

Grade Completing This Year: ____

Home Address: _____

Probable College Major(s): _____

* * * * *

For information only: Sex: female ____ / male ____
(optional)

Ethnicity: _____

ENCLOSURE B

Student: Eric Banners
Contract/Grant: N00014-88-K-0628
Project Director: Robert F. Beck
Title: "Nonlinear Ship Motions"

Student: Susan Carrara
Contract/Grant: N00014-89-J-3214
Project Director: Guy A. Meadows
Title: "LeGrangian Velocity Profiles in the Full Scale Wake"

Student: James Carson
Contract/Grant: N00014-89-J-1723
Project Director: William Williams
Title: "Investigation of New-Time-Frequency Analyses of Acoustic Transients"

Student: Sarah Devine
Contract/Grant: N00014-89-J-1199
Project Director: Gerard Faeth
Title: "Supersonic Multiphase Mixing Layers"

Student: John Dilligard
Contract/Grant: N00014-86-K-0684
Project Director: Robert F. Beck
Title: "Program for Ship Hydrodynamics"

Student: Aaron Edwards
Contract/Grant: N00014-88-K-0637
Project Director: Noboru Kikuchi
Title: "Computational Aspects of Mechanics of Nonlinear Composite Materials"

Student: Lisa Harwood-Stamper
Contract/Grant: N00014-88-K-0554
Project Director: John Laird
Title: "Integrating Learning of Perception and Cognition in SOAR"

Student: Amy Koengeter
Contract/Grant: N00014-89-J-3214
Project Director: Guy A. Meadows
Title: "LeGrangian Velocity Profiles in the Full Scale Wake"

Student: Eric Lofstrom
Contract/Grant: N00014-90-J-1065
Project Director: Ward D. Getty
Title: "Electron Beam Analysis for Cyclotron Harmonic and Free Electron Laser Devices"

Student: Matt Postiff
Contract/Grant: N00014-89-J-3183
Project Director: Gerard Mourou
Title: "Transport in SiO₂ on the Picosecond and Femtosecond Timescales"

Student: Mark Richardson
Contract/Grant: N00014-85-K-0122
Project Director: Kang G. Shin
Title: "A Structured Characterization of Real Time Computing Systems"

Student: Eric Troesch
Contract/Grant: N00014-87-K-0740
Project Director: Jay Elkerton
Title: "On-line Aiding for Human-Computer Interfaces"

Amy Koengeter

The job program I have participated in this summer I have found to be very beneficial. During the course of my 200 hours I have done and learned many things. I started out by working in the tow tank for a week and a half. The first thing I worked on was the Midland project. The purpose of this project was to discover the best way to load a barge. I created graphs on the computer and did calculations that were used in the making of these graphs. In the tow tank just before I left we were calibrating wave probes used to measure the wave height.

After this I went to the Ocean Engineering Lab and have worked here the remainder of the 200 hrs. I have been working on a variety of projects and the one I mainly worked on is for the proposed harbor in Cross Village, Mi. I have done many things to find out if this proposed harbor will change the environment and if so how. I have measured the distance from shore to different contours of depth, and looked at the depth in different areas of water near the shoreline. I have taken this information along with other information given and have inserted them into data tables which in turn I used to calculate the wave height, angle, and period. Later someone will insert all of this information into a program which will show if it is alright to build the harbor.

This program was especially beneficial to me because it gave me the opportunity to work on different computers. I did not have a very vast computer knowledge and most of the things I did involved a computer so now I know a lot more about computers and how to operate them.

I think the Navy should offer this program again because of this program I am going to do a mentorship with Dr. Meadows during the school year. I don't think I would have ever thought of doing a mentorship in this field but because of this program I am.

Susan Carrara

Of the five weeks I spent working in the Office of Naval Research, one and a half were spent at the Ship Hydrodynamics Laboratory, and three and a half at the Ocean Engineering Laboratory.

While at the Ship Hydrodynamic Laboratory, I spent most of my time in the Tow Tank, observing the experiment already going on, and later helping to set up and calibrate equipment for the next experiment. In addition, I spent a day moving information from disks to tapes, and another day in the Engineering Library looking for information on certain topics.

During the majority of my time at the OEL, I made graphs from the data collected in an experiment. A line of bubbles had been made across the bottom of the Tow Tank. These bubbles were let off in several separate runs at varying pressures and created a current. A laser laid down hot spots across the row of bubbles. The experiment was filmed with an infrared camera. By following the progress of the hot spots and finding the speed at which they were moving, one could find out how fast the current moved.

To do this, I first had to record portions of the video tape on to an optical disk player. The optical disk player can send single frames into the computer. With a program made by the person who went through part of the data before, I found out where the hot spots were on a coordinate plane. Another program calculated the velocities between the points and averaged them. Finally, I used the numbers and another program to make the graphs.

I found this experience valuable mainly because I had the opportunity to use computers a lot, and not only for word processing. While here, I have used an IBM on occasion, but the majority of what I have done has been on a Macintosh. It is coincidentally helpful in that most of the computers at my school are Macintoshes.